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ABSTRACT

Successful educational improvement efforts stem from processes and forces that are indigenous to a given setting. Efforts at problem-solving stimulate and are reinforced by a closely related phenomenon: the individual and professional growth of the persons involved. Developmental efforts in education must proceed from a substantially different perspective than has been the case in the past: it must be admitted that the classroom is an essential frontier of action; that teachers are key decision-makers for what actually happens in the classrooms; that innovation will be employed successfully only when related realistically to teachers' awareness of their objectives and needs; that the same essential conditions hold for other professionals; that a change strategy attempting to help individual professionals improve their effectiveness in dealing with perceived problems will have a greater potential for facilitating the testing and adoption of innovations; and that the utility of particular disciplines commonly associated with the change process, such as research or evaluation, depends on their function in the development of the process suggested above. The extensive outline for a support system for problem-solving presented here is based on tests of four models in several school systems in Ohio.
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FACILITATING BUILDING-LEVEL PROBLEM SOLVING: ADOPTING SYSTEMS DESIGN TO HUMAN DEVELOPMENT

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FACILITATING BUILDING-LEVEL PROBLEM SOLVING: ADOPTING SYSTEMS DESIGN TO HUMAN DEVELOPMENT

Robert R. Bargar

During the past ten to fifteen years, substantial amounts of human energy and resources have been poured into attempts to develop improved instructional materials and techniques. Accompanying these developmental efforts has been a great deal of research and evaluation aimed at testing and demonstrating the gains in educational output that could be expected. While many of the instructional innovations that have resulted have been successful, the overall picture that emerges is inconclusive at best. Research and evaluation reports are filled with conflicting findings regarding the merits of many innovations.

Furthermore, the dissemination and utilization of innovations has been a continuing problem. One factor behind the severe cut-backs in budget for the R & D Labs and Centers has been their consistent difficulty in demonstrating the widespread adoption and impact of instructional products. The fiscal and personnel resources of the labs have been limited primarily to product development rather than adoption.

When undertaken, however, systematic efforts at dissemination and installation are not necessarily effective. Many factors have the potential to adversely affect the installation of an innovation; these factors have been treated extensively in the literature on social change and their review is beyond the scope of this paper. My interest here rather is to approach the problem of change from a particular perspective and to develop a series of recommendations for moving more productively into the arena of utilization. The ultimate goal of course is to find more successful approaches to facilitating improvement in schools.

Throughout this paper, I will be operating from one central proposition: that successful educational improvement efforts stem from processes and forces that are indigenous to a given setting. Specifically, they result from efforts at professional problem solving by persons responsible within that setting. Efforts at problem solving stimulate and are reinforced by a closely related phenomenon: the individual and professional growth of the persons involved.

Consider teachers for a moment from this perspective. A teacher clearly has the most influence over the quality of learning of children. Accordingly, most instructional products are designed for utilization by teachers and the children with whom they work. However, a teacher who does not understand or appreciate the uses of a particular instructional resource is apt to treat that resource in such a way as to diminish or negate its effectiveness. Understanding the utilization of a resource requires relating that resource successfully to the specific objectives and styles of individual teachers. It is therefore critical that teachers understand the possibilities that are inherent in a resource for their individual situations.

It is precisely at this point, that many instructional development efforts have failed. By and large, instructional innovations tend to be viewed by their creators as commodities to be disseminated to teachers with the assumption that teachers would use them as "instructed." Insufficient regard has been given to the professional autonomy which teachers possess and employ readily within their classrooms. The position taken here is that a teacher's own development in her understanding of the nature of children's learning problems, her formulation of the teaching objectives which reflect these problems as she understands them and her participation in the design of the utilization of a resource in her classroom are all essential to the successful utilization of that resource. A teacher's professional and individual development in this

sense is critical to her ability to effectively participate in the development of children.

The same can be said of persons in other professional roles in schools. Each within his or her own sphere is faced with a given range of problems; each is confronted with the necessity for individual growth and for problem solving behavior to meet the needs of very real situations.

The foregoing suggests that developmental efforts in education must proceed from a substantially different perspective than has been the case in the past. First, we must admit to the classroom as an essential frontier of action. Efforts that do not ultimately bring about positive change in behavior of students and teachers are of little real value.

Second, teachers are key decision makers for what actually happens in classrooms. What they perceive, what they value, what they decide and how they act are critical. Development in the classroom thus requires development in the teacher. Otherwise, there will be little behavioral change regardless of the "newness" of the materials or equipment used.

Third, innovations will be employed successfully only when related realistically to the awareness of teachers of their objectives and needs. The incorporation of new methods and materials is then a function of successfully interfacing such innovations with teachers' attempts to improve their own effectiveness, with the final decision on trial or adoption being individually or collectively in the teachers' hands.

Fourth, the same essential conditions hold for other professionals; their utilization of new procedures and processes is a function of successfully interfacing such innovations with their attempts to improve their own effectiveness.

Fifth, given this perspective, a change strategy that attempts to help individual professionals improve their effectiveness in dealing with problems

they perceive will have a greater potential for facilitating the testing and adoption of innovations. I am referring here to more than the commonly held dictum that the "chiefs" should include the "indians" in decision making if the innovation is to be "accepted". Rather, the innovation should be a function of, or perhaps better yet, an expression of, the attempts of both "indians" and "chiefs" to analyze and to improve their individual and collective performance. At the very least, the innovation and the processes employed in its utilization should possess the potential for becoming a vehicle for the growth of the persons involved.

Sixth, the utility of particular disciplines commonly associated with change processes, such as research or evaluation, depends upon their function in the developmental process suggested above. As with instructional innovations, their utilization will also be a function of successfully interfacing appropriate methodologies and skills with teachers' and other professionals' attempts to improve their own effectiveness. What I am implying here of course is a shift from the preaching commonly heard that teachers, et. al., "ought" to use evaluation or research, to the employment of strategies for professional and individual renewal within which technologies such as evaluation can become functional tools that are welcome.

If you glance back over my previous comments and statements, you will see that I am proposing an evolutionary view of educational development and change, a view that takes the individual professional as a key in the process. This view does not negate group process nor necessarily lessen the role of administrative authority or centralized decision making. Rather it attempts to establish a balanced perspective. The evolution of individual professionals is critical to the evolution of schools as settings for the growth and learning of children. This is as true of the administrator, or "central decision maker", as it is of a classroom teacher; furthermore, it is an indispensable ingredient

in fruitful group and organizational processes. Thus, positive change is viewed here as the result of the stimulation of growth processes intrinsic to the individual. The evolution of individuals within an organization is thus seen as critical to its ultimate success and to its shape, character and content. The integrity of individuality is forever present; inevitably it takes its toll, extracts its pound of flesh, exerts its influence, whether positive or negative.

Last Spring, the Ohio State Chapter of Phi Delta Kappa sponsored a conference in problem solving in educational settings. At this conference I presented a paper that outlined two interlocking schemas that take into account the preceeding propositions. The first of these schemas was an approach to problem solving at building and classroom levels designed to facilitate the diagnosis and solution of instructional and administrative problems, with the teachers and administrators responsible for dealing with those problems being the major actors. Technical aspects, such as evaluation, were viewed as specific sets of facilitating skills serving important functions within a larger process. Establishing problem-solving as a systematic, on-going process, should provide for a continuity of creative work necessary to the continual renewal of teaching and administration.

The second schema proposed structured arrangements through which university-based personnel could stimulate and facilitate the development of problem solving capabilities in schools and classrooms. This schema interfaced inservice training, staff development, graduate programing, and team building strategies around applied problem solving in a building setting. The ultimate intent of both schemas is the improvement of schooling for children.

During the past year we have had the opportunity to test the schemas that were presented in this paper in several school systems in the Ohio State University area. These opportunities have been valuable in refining and clarifying

those elements that appeared to be most relevant. In developing the present paper my purpose has been to explore the utility of several systems models for their utility in revising the original schema. The first of these models was that developed by Gerald Nadler and published in his book entitled Work Design: A Systems Concept. The second model was one that I developed several years ago and which was presented at a symposium held at the AERA convention in 1973. The third model is that developed and presented by Bela Banathy in his book entitled Developing a Systems View of Education. The fourth model is the SIGGS Theory formulated by George and Elizabeth Maccia. While all of these models have had some impact upon the material that follows in this paper, I will be referring primarily to the models developed by Banathy and by the Maccias. I found these models to be most useful in organizing various aspects of our experiences with problem solving in schools.

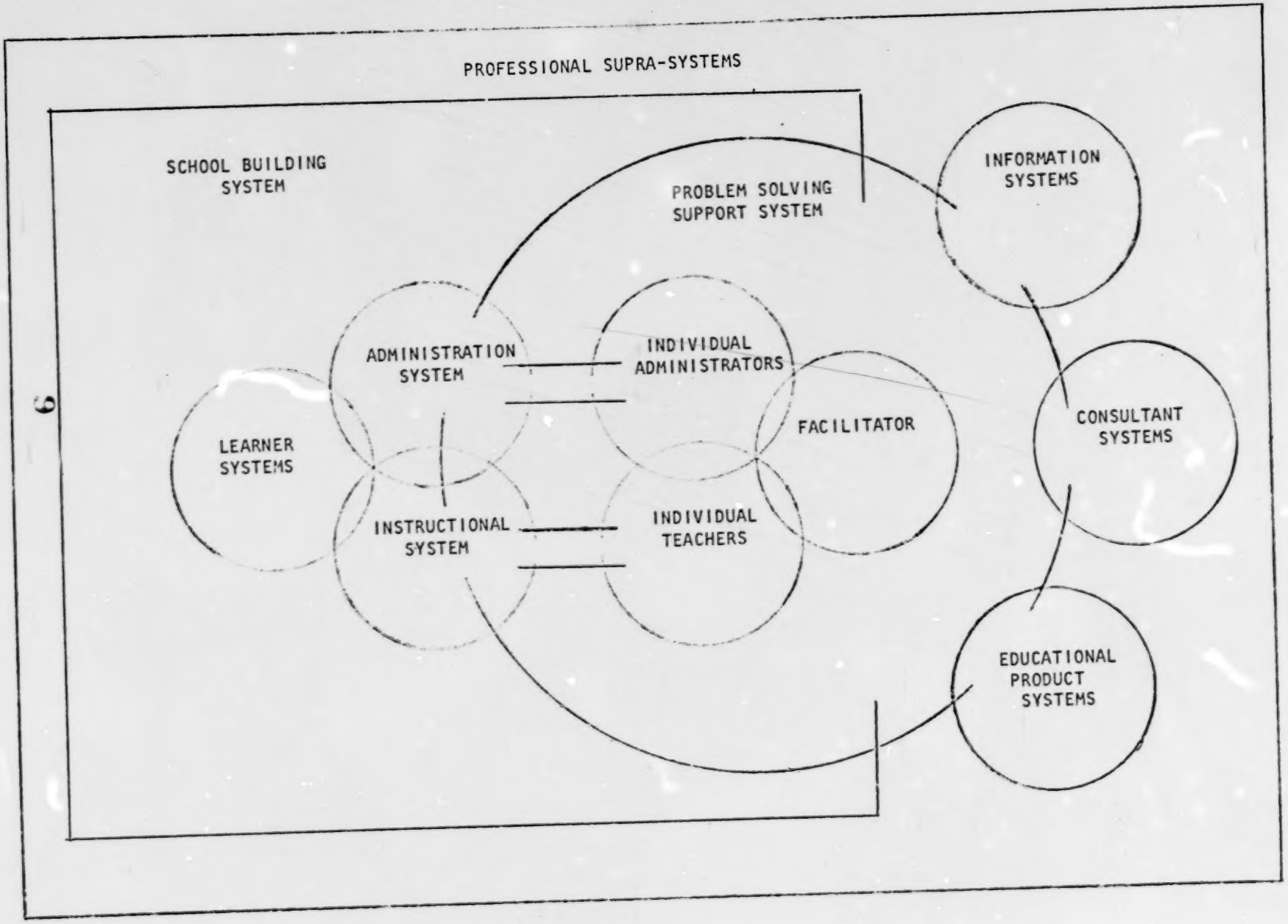
Outlines of a Support System for Problem Solving in Schools

Environment of the Support System

Our first level of consideration will be that which Banathy refers to as the general systems environment model. In Figure 1, I have identified the major peer systems and suprasystems with which the problem solving support system is related. The first thing we note is that the support system transcends the boundaries of the building system of which it is an essential part, with the purpose of interrelating various professional service systems to those problem solving activities occuring within the building system. Within the building, the problem solving support system interacts primarily with individual teachers and administrators who are involved either singularly or in groups in problem solving activities. Through the activities of these individuals the support system in turn comes into contact with the administration system and with the instructional system, broadly defined, as these exist within the building. Indirectly the support system becomes involved with individual

Figure 1

PROBLEM SOLVING SUPPORT SYSTEM: ENVIRONMENT



learners and in that sense with learner systems. However, the primary function of the support system is to facilitate problem solving activities of individual teachers and administrators.

Given the trans-system linkage function of the problem solving support system, its physical boundaries then become quite diffuse, touching upon a number of systems both within the building and external to the building. Its economic boundaries also are relatively diffuse, including not only the resources of the school building or the school systems within which it primarily resides, but also those resources that are available through services of agencies such as State Departments of Education, universities, regional labs, federal agencies, etc. These resources can be described both in terms of free professional services as well as in terms of funds that may be available for special programs. In this sense the support system can provide a resource linkage function that can be important to the activities within the school building itself. The physio-biological characteristics of the support system can be defined primarily in terms of those characteristics of teachers, administrators and support system personnel who are engaged in problem solving activities. To a lesser degree it would also include those external resource persons who become involved in building activity, as well as students and parents. The psychological boundaries of the support system are defined by the attitudes, beliefs, customs and traditions of those persons within the building, and by an even more general characteristic which we may simply label the climate of the building itself as a total system. The social boundaries of the system also extend beyond the building itself to include those community and professional agencies and settings with which the support system may become engaged while serving its primary function with persons within the building.

Those entities that affect the system or with which the system may become engaged would include teachers, administrators and other school personnel

directly involved in problem solving. Related entities would also include the various definable systems within the building, such as the administrator system and the instructional system, and would also include those various resource systems external to the building with which the support system would become engaged. Within the building, we could also name such entities as the children involved, the physical plant, space, equipment, etc.

The most important inputs of the problem solving support system are those related to the clients which the system is designed to serve. These clients would be those teachers and administrators involved directly in problem solving. Inputs from such persons would include the problems with which they are attempting to deal, information coming from them to persons within the support system, their attitudes, perspectives, etc. In addition to client inputs, there would also be resource inputs to the support system. These would include information available concerning educational programs and students within the building or within the school system at large, materials and equipment which might be involved in problem solving activities, technical expertise of persons external to the building, etc. The primary outputs of the support system would be the services provided to teachers and administrators engaged in problem solving. These would include such things as information linkage, technical assistance, consultants contacted, skills developed on the part of problem solvers, interpersonal skills and team phenomena developed within the building, etc. Feedback from the environment to the system would include evaluation of the adequacy of the services of the system to its clients within the building.

The relationship between the problem solving support system and its clients is primarily a hierarchical one. The support system is created to serve the needs of its clients within the building. As these needs change so the system itself would have to change in order to better fulfill its functions. In this sense the support system is subordinate to its client systems. The

relationship of the problem solving support system to those systems outside of the school building is centralized, i.e. its function is to intergrate the resources of various external systems so that these may be brought to bear more efficiently on problem solving efforts within the building itself. We could of course apply such adjectives as open, adaptive and self-regulating to the problem solving support system as we conceive of it.

System Structure: Needs-Goals-Functions-Components

The major purpose of the problem solving support system is to facilitate problem solving activities of individual teachers and administrators within the building. The major entities being transformed by the system are services related to the problem solving activities of such persons. Concomitant transformations involve the values, skills, and professional and individual development of the persons involved. The needs being met by the system are those which can be identified as germane to problem solving behavior. These needs can be summarized as follows:

(1) Information of a feedback nature which would be internal to a school building, including that information from classes of an individual teacher who might be involved in problem solving, as well as additional information from within the building that might be useful;

(2) External information from sources outside the building that could be useful in diagnosing the nature of the problem being dealt with in a particular instance, and in identifying those solutions or alternatives that might be available to the problem solver;

(3) Skills necessary to successful problem solving;

(4) Technical assistance in the processes of problem solving;

(5) Facilitation of problem solving processes, probably involving direct personal interaction with another individual serving as a facilitator;

(6) Technical linkage between problem solving efforts within the building and external resource systems and personnel (consultants);

(7) A climate within the building conducive to the support of problem solving behavior;

(8) Facilities and equipment necessary to conducting problem solving activities;

(9) Flexibility in arrangements and scheduling in order that solutions be tested;

(10) Time on the part of personnel to engage in problem solving activities;

(11) Financial and personnel resources necessary to support problem solving activities;

(12) Team building activities for those situations involving group problem solving efforts.

Figure 2 provides a listing of the systems goals and functions which can be derived directly from this list of needs. We should indicate that the above list of needs has been generated from literature in problem solving, creative behavior, and educational and social change, in addition to the experience of the author and his colleagues in working with problem solving teams in schools.

Before discussing components of the problem solving support system, we need to discuss some very general considerations concerning the nature of the system itself. First, the system would consist of individuals and institutional arrangements whose purpose it is to serve clients who are dealing with perceived professional needs. It would be a mistake to think of the support system in a highly structured sense. Rather, given the informal character of relationships within a school building as a social system, the support system would need to be thought of as a loose federation of available resources and capabilities to be called upon and integrated by the client with the help of another person serving as facilitator. The system would not be characterized in most buildings by extensive equipment, office space or administrative arrangements. Rather, its major components could well consist of a facilitator or facilitators whose responsibilities are to articulate a variety of

Figure 2

Goals - Functions: Problem Solving Support System

1. To provide external information linkage for problem analysis and solution selection/development.

2. To provide internal information linkage for feedback.

3. To provide training in skills necessary to problem solving.

4. To provide technical assistance in problem solving.

5. To provide linkage to technical expertise.

6. To provide process facilitation to the problem solver in his attempts to deal with the problem.

7. To provide team building experiences for group problem solving.

8. To stimulate and otherwise help develop a climate in the building conducive to problem solving.

9. To coordinate or help coordinate, among problem solvers and administrators, the use of facilities, equipment, scheduling, time, etc., necessary to problem solving.

10. To coordinate, or help coordinate efforts to plan for and acquire resources for problem solving.

resources both from within the building and external to the building in relationship to client problems. Thus as we proceed to discuss components, we will find that certain functions tend to generate observable objects or arrangements that are extant within the building, while others will require the identification of services and resources which can be tapped but which will not normally be a functioning part of the building itself.

External Information Linkage--Information is a critical ingredient in becoming aware of and diagnosing problems, and in selecting and evaluating solutions. A very early step in implementing a systematic approach to problem solving would be to establish contact between individual professionals in buildings and external information services and sources such as ERIC, Phi Delta Kappa's School Research Information Service, university libraries, community agencies, etc. A second step would be to establish a carefully selected library of reference sources and key references within the building. Training teachers and administrators to use these materials and resources would be a very important related task. This would include at least some minimal training in the evaluation and utilization of knowledge obtained from such sources.

Some problems would also require information from other sources internal to a school system but external to a particular building, such as school-wide test results, managerial data, etc. Accessibility to records and other information sources within a school system would require cooperation among personnel and some minimal system for storage, retrieval, and communication. Guidelines for accessibility to and use of such data would be important.

Internal Information Linkage--Problem solving will also require information from those sources internal to a building, such as student files, data from individual classes, program evaluation data and so forth. Especially

critical to individual teachers will be feedback information concerning their own behaviors in their classrooms. Training in the generation and interpretation of such data will be especially important as a part of any general problem solving strategy. Accessibility to such data generated within a building will require cooperation among personnel and will also require some system within the building for storage and retrieval. At the minimum, there should be arrangements for test scoring and item analyses of classroom tests and evaluation instruments. Availability of statistical analysis would be important as problem solving efforts begin to reach field test or evaluation stages. Most schools do not have this kind of capability, but can establish service relationships with other institutions that do.

Facilitation--Practical limits in skill building coupled with serious limitations in time faced by all school personnel suggest the need for a building-based support person who could provide on-site help to individuals at various stages of problem solving. Such a person would need a breadth of skills, including a knowledge of the dynamics of interpersonal relationships in school settings. His/her most important function would be to facilitate problem solving in its various stages through direct assistance given to problem solvers. Such a role may not necessarily be new in at least some of its aspects. Principals, coordinators, and even fellow teachers to some extent have provided limited technical and psychological support to each other in specific circumstances. What we are suggesting here however, is a more thorough-going set of behaviors to which we might attach the term "developer." This developer role might be played by an existing person or persons in the building, or might involve a new person added to an existing staff.

The developer's role would be defined by those various functions which we have identified above. Some of these functions would engage a considerable

amount of time, while his relationship to others would be somewhat more indirect. During early stages of problem solving, a very critical function of the developer would be to assist problem solvers in identifying and analyzing problems. The developer could provide technical help, including information linkage and psychological support, in addition to serving as a kind of conceptual catalyst, sounding board, devil's advocate, etc. Other functions of the developer would include the facilitation of: (1) inservice instruction, (2) team building, (3) technical linkage to external consultants, (4) stimulation of a climate conducive to problem solving, (5) coordination of special arrangements that might be necessary for problem solving, including flexibility in scheduling, equipment, etc., (6) coordination in the obtaining of additional resources, both financial and personnel, that might be needed in a particular building setting. These latter functions may require some additional explanation. I am not suggesting that the developer would take over the administrative roles in the building related to equipment, scheduling, space and so on. What I am suggesting is that the developer would work closely with problem solvers and administrators in making arrangements for obtaining these various resources.

Generally, the following conditions are most critical in the author's view for enhancing the effectiveness of the person in the facilitator role:

(1) that he genuinely be able to listen to the problem solver and to understand the problem and his perspective, i.e. that he not have a personal axe to grind on the issues involved,

(2) that he remain open as regards to a best solution, i.e. that he not have a "pet solution" that he then tries to lay on the problem-solver,

(3) that he maintain open communication to all parties in a group setting; ie. that he not be seen as an advocate of one person or position,

(4) that he maintain credibility in the eyes of the problem-solver, i.e. that he not allow himself to be viewed as an agent of the administration or any other outside party.

Havelock, in his excellent handbook and guide to innovation in education, recognizes these factors and lists additional ones that are important. Time simply does not permit us to discuss this issue in more detail here.

Skills: In-Service Training

The types of activities that we have outlined will require skills that most teachers and administrators have had little opportunity to acquire. The sophistication of some of these skills and the time required for their mastery both suggest the need to establish a practical, feasible approach. Problem solvers would need to develop elementary, application-oriented skills in the areas listed in Figure 3. More sophisticated skills in these areas would have to be supplied through the availability of technical support personnel. Systematic programs in inservice training would be helpful in improving the problem-solving capability of individuals involved. Integrating such training with problem solving processes would hopefully provide a climate for more efficient learning. The schema of university-school cooperation to be presented later provides a natural setting for such training.

Building Climate

Previous experiences in building and classroom level "action research" and "evaluation" have convinced the author that the psychological climate within which individual problem solvers work is critical. First and of foremost importance is the problem solver's own perspective on his activities. His values and his perceptions are critically manifest in his approach to the problem; thus directly affecting the outcome. Furthermore, the degree to which the problem solving activity is consonant with his own individual and professional

Figure 3

Skills Utilized by Clients (Teachers, Administrators) Engaged in Problem Solving

An understanding of individual developmental processes as these relate to problem solving.

An understanding of ones own creative behavior in problem solving.

Skills in self-discipline for creativity in problem solving.

An understanding of group processes.

Skills in interpersonal communications.

An understanding of the stages in development/problem solving processes.

Skills in linking with information systems.

Skill in assessing and utilizing information.

Skill in analyzing and synthesizing problems.

Skills in stating goals and objectives.

Skills in identifying, simulating and assessing solutions.

Skills in selecting and/or designing solutions.

Skills in interfacing with consultants.

An understanding of the stages in evaluation processes.

An understanding of the uses of various evaluation instruments.

Skills in developing selected instruments.

Skills in collecting data.

Skills in using selected analysis techniques.

Skills in interpreting data and assessing the value of a solution.

development effects the energy, inspiration and dedication that he can bring to the task. Is his professional work a medium for his own individual and professional development; do his problem solving attempts represent a significant individual thrust? These are critical questions.

We discussed these questions earlier in a somewhat different way when we discussed the importance of individual creativity as a crucial aspect of the change process in schooling. The interface between the thrust of individual creativity and the overarching goals, values, and climate of the building provides the crucible within which problem solving occurs. This crucible requires both freedom and responsibility: the freedom to pursue innovative ideas, to discuss, test, refine and evaluate their implications; the responsibility not only to challenge the system when fruitful but to retain functional continuity with previous practices, and to maintain integrity of learning experiences for children.

Looking beyond the perspective and attitudes of the individual problem solver we can identify several important conditions within the building that are important to problem solving. These would include (1) administrative support and leadership, (2) feelings of trust and respect among colleagues, (3) willingness of colleagues to accept innovative behavior, (4) open channels of communication among individuals, and (5) willingness of individuals to cooperate with each other in group activities when necessary. At this point of course we are talking about skills and processes that are germane to the field of staff development. One of the important activities of the building developer or facilitator would be to conduct a program in building-wide staff development.

Team Building--Many problems confronted in school buildings will require group effort for their solution. Team building will become a very necessary

reality in order for problems of this type to reach a successful solution. Within the support system that we are suggesting, we would see the team-building function as being coordinated primarily by the developer or building facilitator. His role would be to assemble a group of persons concerned with common problems, and then to employ group process techniques that would help build a team spirit and a willingness for group cooperation among the individuals involved.

Technical Assistance/Technical Linkage--Technical assistance in many aspects of problem solving could be provided by the building developer as we have defined that role above. In some cases however technical assistance beyond the capability of the developer may be required. In these situations, the developer can provide a technical linkage function to external consultants who have the capacity to provide the level of skills needed by the problem solver or by a problem solving team. The developer himself might contact such a consultant or he might put the problem solving team or the individual problem solver into contact with the consultant.

Coordination of Activities--The various coordinating functions listed in Figure 2, would within our support system be provided primarily by the building developer. Again coordination here does not mean the assuming of administrative responsibilities usually carried out by the building principal or by other administrators. What we are referring to instead is the linkage of those administrative services to the efforts of individual problem solvers or problem solving groups. We view the developer as performing a very important role here in helping to generate resources and in helping to manage changes in scheduling, space utilization, and so on, that would be required for successful problem solving. The developer would also perform a very important function of coordination and communication among individual problem solvers or among problem solving teams.

Support System Processes

Our major purpose in discussing support system processes is to convey some realistic idea of how system components would interact. We will examine system processes at both macro and micro process levels, and in relation to specific phases of problem-solving activities. As we have suggested above, the problem-solving support system is not a highly structured and closed system, but rather may be described as a network of capabilities that can be activated in relation to differences among clients, among problems and among phases of problem solving activity. Thus, a fairly concrete approach is required to illustrate the operations of the system.

Macro-Process Description--We have stated earlier that the major function of the support system is to facilitate problem solving efforts of clients, that is, to provide inputs for utilization by clients. It's operations are thus essentially service in nature, and are affected primarily by the needs of clients. If we examine client operations during a given phase of problem solving activity, we can list and describe those inputs required from the problem-solving support system. These inputs to the client system represent outputs and major entities being transformed by the support system. These inputs also represent points of transaction between the client system and the support system. For the sake of discussion we will examine the problem analysis phase of problem solving.

Several of the systems models I have reviewed provide very useful paradigms for analyzing and describing client system processes involved in problem analysis. The left hand column in Figure 4 lists major systems processes as identified by Banathy. The right hand column provides a listing of inputs from the support system related to these processes during problem analysis. This listing draws upon the description of functions and components of the support

Figure 4

Client System Processes:
Inputs from the Problem-Solving Support System During Problem Analysis

Client System Processes	Inputs from the Support System		
Inputs	Facilitator assists client in obtaining information from one or more of the following sources:		
	Information Systems	Consultants	Evaluative Data: Client Feedback
Interaction	List possible information sources	List possible consultants	List possible data of value
Identification	Select relevant sources	Select relevant consultants	Select relevant data items to be collected
Activation	Information sources	Consultants engaged	Data collected, analyzed, interpreted
Feedback	Client and facilitator assess value of sources	Client and facilitator assess value of consultant	Client and facilitator assess value of data
	——— Input process recycled as necessary———		
Transformations	Facilitator assists client in formulation of problem and objectives through the following:		
	Critical Evaluation	Psychological Support	Management
Production:			
Operations	Evaluate client ideas/ make suggestions	Facilitator accepts and encourages client	Facilitator arranges schedule of sessions, coordinates resources
Systematization	Facilitator works to improve quality of relationships with client; facilitator and client work to increase effectiveness of individual efforts; facilitator and client work to improve effectiveness with other systems operations.		

figure 4 continued

Facilitation:			
Energizing	Facilitator helps coordinate obtaining of resources: provides psychological stimulation		
Maintenance	Facilitator and client maintain schedule of contacts, conferences, work sessions. Facilitator attempts to coordinate resources and arrangements necessary: time, consultant fees, scheduling, etc.		
Control:			
Monitoring	Evaluator seeks feedback from client concerning quality of:		
	Facilitator's critical evaluations and suggestions	Facilitator's psychological support	Facilitator's managerial support
Analysis	Client feedback is analyzed and interpreted		
Adjustment	Changes in services assessed, selected and implemented		
Output			
Model	Facilitator assists client in identifying criteria for assessing a conceptual framework and objectives.		
Assessment	Conceptual framework and objectives assessed.		
Dispatch	Conceptual framework and objectives used to pursue problem solution.		
Feedback			
Collect Evidence	Facilitator assists client in obtaining feedback information concerning:		
	Client output: conceptual framework and objectives (see Output above)	Client processes during problem analysis	Long range value of output through further problem-solving stages

Figure 4 continued

Analyze and Interpret Evidence

Construct models of Adjustment

Stipulate Consequences of Adjustment

Introduce Adjustment

Facilitator and evaluator analyze data, identify adjustment alternatives, assess alternatives, select and introduce adjustment in facilitator and client behaviors.

system discussed (Figure 2) in the previous section, and attempts to articulate these in a wholistic fashion. In addition to activities I have also attempted to identify actors, and in this fashion have attempted to describe the central role of the problem solving facilitator or developer.

Input processes involve interaction, identification, activation of inputs and feedback. Inputs from the support system consist primarily of information obtained from one or more of the following sources: external information systems, external consultants, and the collection internally of feedback data concerning previous behavior of the client and/or other educational outcomes within the building. The facilitator and the client would work together to list, select and obtain information/data from one or more of these sources (see Figure 4) depending on need. The client and the facilitator would assess the value of the information derived and make adjustments in their operations designed to improve the quality of information obtained and the efficiency of the facilitator's behavior. These input processes would be recycled as needed.

Transformation processes include production, facilitation, and control. The primary entity being transformed through the system consists of the problem solver's conceptualization of the problem. The output presumably would consist of a well articulated frame of reference for viewing the problem and a set of fairly specific objectives for dealing with the problem. Inputs from the problem-solving support system would include (1) critical evaluations of the client's work by the facilitator, (2) psychological support from the facilitator, and (3) management and resource coordination by the facilitator. Production operations would include work sessions between client and facilitator as well as individual work sessions for each. Production systematization would involve the development of productive relationships between the client and the facilitator. It would also include efforts to increase the client's

skill in dealing conceptually and creatively with the problem, and the facilitator's skill in working with the client. Facilitation processes include energizing and maintenance. Energizing would include efforts by the facilitator to stimulate the client, to provide him with useful suggestions, and to generally supply a supportive psychological climate within which the problem solver can work. These supportive movements on the part of the facilitator would be designed to increase the client's level of motivation and available energy in dealing with the problem. Maintenance processes would refer to efforts by the facilitator to maintain a functional schedule of contacts with the client, and to coordinate resources and arrangements.

Transformation control processes would include monitoring, analysis, and adjustment. Monitoring information would consist of feedback from the client to the facilitator on the quality of (1) the facilitator's critical evaluations and suggestions, (2) the psychological support provided by the facilitator, and (3) the facilitator's managerial behavior. It would also include an attempt by both the facilitator and client to assess the adequacy of their individual efforts, as well as the adequacy or productiveness of their common work sessions. Important here of course, is an assessment of the quality of interpersonal relationships. Analysis would refer to the analysis of the feedback information which we have discussed. Adjustment would refer to decisions and actions taken to improve the relationship between the facilitator and the client, and to improve their individual efforts in dealing with the problem.

Output processes include (1) identification and assessment of the output of the system and (2) the dispatching of relevant output. Identification and assessment of systems output involves the utilization of an appropriate output model as a basis of judgment. We have identified the output of the system at this point as consisting of a well articulated frame of reference and a set of objectives related to the problem. While one could not easily create a

substantive model for a specific problem, one could identify criteria for judging the conceptual adequacy of a frame of reference and for judging the clarity and utility of stated objectives. These criteria could then be applied to assessing the output. If deemed adequate the conceptual framework and objectives developed could then be utilized as a basis for designing or for identifying existing solutions for the problem.

Feedback processes would include the collection and analysis of information concerning the adequacy of system operations while engaged in problem analysis. The primary question is "What changes in procedures could have yielded a more beneficial effort?" Procedural alternatives could be identified, assessed, selected and introduced into the system. The central actor in this process would probably be the facilitator, although hopefully he would have access to the services of an independent evaluator.

A review of systems operations in this one stage of problem-solving reveals several important considerations. First, the support system, in supplying relevant inputs (needs) into the client system, has integrated at least the following systems components or entities:

facilitator
client
evaluator
information systems
information sources and bits of information
consultant(s)
facilities
time/scheduling
financial resources
data processing capabilities
multiple clients in a team relationship

Second, these components include person systems as well as social systems and machine systems. Third, the support system depends on relatively informal mechanisms and relationships. Fourth, we can see that as we would move to other stages of problem solving, different arrangements of resources, persons,

and systems would be necessary. Different problems in turn, would require somewhat different constellations of resources and systems even at the same stage of problem solving. Thus, the system as such must include a wide range of available services and resources. Its boundaries in that sense are diffuse and easily alterable. We can see then the degree to which the system needs to be open and adaptive. At the same time there needs to be clear feedback and control over a potentially wide range of activities, many of which are person-centered, informal, and some external to the building itself.

Micro-Process Descriptions--In the previous discussion we described various support system behaviors which functioned as inputs to a client during problem analysis processes. These behaviors constitute outputs of the support system and their production can be described in systems terms. As an illustration of the applicability of systems design at this level, I will utilize the SIGGS model developed by George and Elizabeth Maccia, which seems to me to be particularly useful for defining these micro-level behaviors. For our purpose here, we will be concerned with only one aspect of problem analysis: the process of interacting with information systems for information that may be useful for problem analysis. If we refer back to Figure 4, we can recall that this is one of three types of information processes potentially useful to the client. The facilitator's role here is to provide information, or to otherwise help the client obtain information of value from available information systems. This process involves interactions among client, facilitator and information system.

The SIGGS model developed by Maccia and Maccia constitutes an integration of set theory, information theory, graph theory and general systems theory. It is described by its authors as providing an extension of the basic cybernetic model such as to account for the behaviors of self-constructive systems (Maccia

and Maccia, 1975). In the present author's schema, the client and facilitator should be viewed as living systems, that is, as life forms that are self-constructive rather that merely self-maintaining. The model thus seems appropriate to delineate their behaviors during problem-solving. Figure 5 provides an outline of the SIGGS model with a brief description of each major function in the system (Maccia and Maccia, 1975). The following outline briefly describes client-facilitator-information systems transactions based on SIGGS theory. In order to limit our discussion to the transactions related to obtaining information, I have begun the outline with the client's decision to contact the facilitator for assistance. This decision I have interpreted as representing the process identified as feedthroughness in the SIGGS model. The outline is intended to illustrate client, facilitator and information system processes within patterns of cross system transactions.

Obtaining Information for Problem Analysis:
Descriptions of Client-Facilitator-Information
System Transactions Based on SIGGS Theory

Client-Facilitator Transaction

Feedthroughness, Client:

Client decides to contact facilitator, reviews information concerning problem to be communicated to facilitator.

Fromputness, Client:

Client's assessment of the problem, client's perception of type of information that may be useful in analyzing the problem.

Outputness, Client:

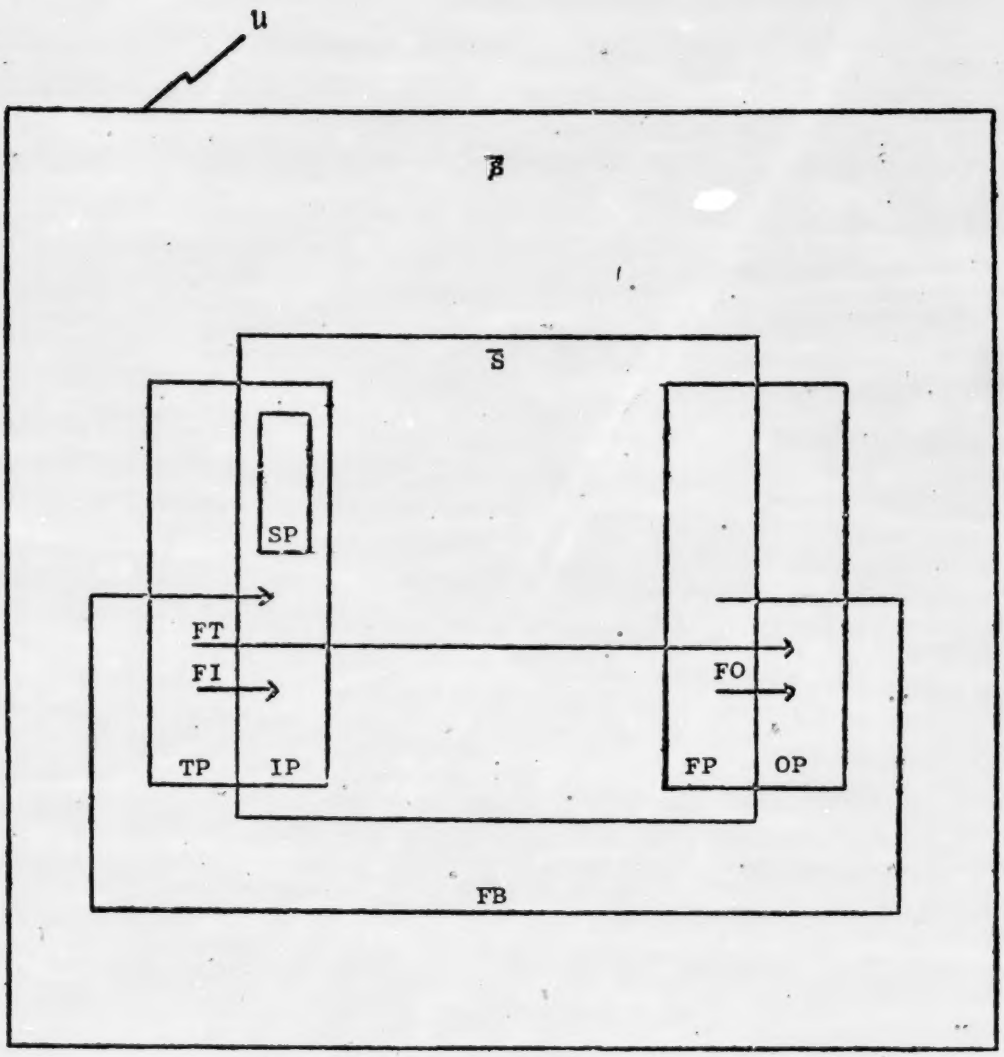
Client perceptions and behaviors, both verbal and non-verbal, communicated toward facilitator.

Feedbackness, Client:

Feedback from the facilitator indicating the adequacy of the client's communications regarding the problem.

Figure 5

Representation of SIGGS Model
Maccia and Maccia (1975)



'u' stands for universe of discourse
'S' stands for system
'S̄' stands for negasystem
'SP' stands for storeputness
'FT' stands for feedthroughness
'FI' stands for feedinness
'TP' stands for toputness
'IP' stands for inputness
'FO' stands for feedoutness
'FP' stands for fromputness
'OP' stands for outputness
'FB' stands for feedbackness

Figure 5, continued

toputness (TP) - the system's environment or the selective information on the negasystem which is available to the system

inputness (IP) - the system's selective information

fromputness (FP) - the negasystem's environment or the selective information on the system which is available to the negasystem

outputness (OP) - the negasystem's selective information

storeputness (SP) - the system's inputness which is not fromputness

feedinness (FI) - transmission of selective information from the negasystem to the system, i.e. T(TP,IP)

feedthroughness (FT) - transmission of selective information from the negasystem through the system to the negasystem, i.e. T(TP,IP,FP,OP)

feedoutness (FO) - transmission of selective information from the system to the negasystem, i.e. T(FP,OP)

feedbackness (FB) - transmission of selective information from the system through the negasystem to the system, i.e. T(FP,OP,TP,IP)

Feedoutness, Client:

Processes of verbal and non-verbal communication from client to facilitator, yielding information as intended by the client.

Toputness, Facilitator:

Messages from the client available to the facilitator.

Inputness, Facilitator:

Information from the client perceived and internalized by the facilitator, including:
(1) Facilitator's perception of the client's perception of the problem.
(2) Facilitator's perception of the client's state.

Feedinness, Facilitator:

Process of verbal and non-verbal communication between facilitator and client, yielding information as perceived by the facilitator.

Facilitator-Information System Transaction

Feedthroughness, Facilitator:

The facilitator shapes and transforms output for the information system in terms of:
(1) His/her perception of the stated goals, needs, view of the problem, etc., of the client.
(2) Capabilities of the information system.
(3) The facilitator's perception of the client's level of development in dealing with the problem.
(4) His/her objectives for growth in the client.
(5) His/her individual/professional objectives in engaging with the client.

Fromputness, Facilitator:

Facilitator's perception of information needs of client.

Outputness, Facilitator:

Information requests selectively arrayed by the facilitator for input into the information system.

Feedbackness, Facilitator:

Feedback from the information system indicating the adequacy of the facilitator's communication regarding the information request.

Toputness/Inputness/Feedinness, Information System:

Processes for activating information requests.

Feedthroughness, Information System:

Processing of information requests

Fromputness/Outputness/Feedoutness, Information System:

Processes for communicating completed information requests to the facilitator.

Feedbackness, Information System:

Feedback from facilitator on adequacy of information system output.

Toputness, Facilitator:

Information sources received by facilitator.

Inputness, Facilitator:

Information sources selected as most useful to the client.

Feedinness, Facilitator:

Process of communication between facilitator and information system.

Facilitator-Client Transaction

Feedthroughness, facilitator:

The facilitator shapes output for the client in terms of:
(1) The sources available from the information system.
(2) His/her perception of the client's needs.
(3) His/her perception of the client's stage of development and capability for using information.
(4) His/her objectives for growth in the client.

Fromputness, Facilitator:

Information sources and bits of information perceived by the facilitator as being useful to the client.

Outputness, Facilitator:

Information and suggestions communicated to the client by facilitator.

Feedoutness, Facilitator:

Processes of verbal and non-verbal communication through which information is communicated to client.

Feedbackness, Facilitator:

Feedback from the client to the facilitator on the adequacy of information communicated to the client.

Toputness, Client:

Information messages from the facilitator available to the client.

Inputness, Client:

Information selected as useful by the client.

Feedinness, Client:

Processes of information communication between client and facilitator.